## Remarks

The Final Office Action mailed 26 June 2002 has been received and reviewed. Claims 27-32 having been added, the pending claims are claims 1-11, 13-15, and 17-32.

The paragraph added herewith has been added to provide material that was incorporated by reference into the present specification at, for example, page 12, lines 30-32. The material incorporated may be found in Applicants' Assignees' copending application Serial No. 09/519,449, entitled "Diamond-Like Glass Thin Films" at page 3, lines 15-24.

Support for the claims 27, 28, and 31 is found, for example, in the pending claims and in the specification at page 8, line 34 to page 9, line 8.

Support for claims 29, 30, and 32 is found, for example, in the pending claims and in the paragraph added herewith at page 14, line 4.

Reconsideration and withdrawal of the rejections in view of the following comments are respectfully requested.

### The Amendment and Response filed April 15, 2002

Applicants' Representative respectfully draws the Examiner's attention to page 6, paragraph 4, under the heading "The Prior Art Rejections" of the Amendment and Response filed by facsimile with the U.S. Patent and Trademark Office on April 15, 2002. Therein it was stated that "[t]here is no teaching or suggestion [in EP 0856592] of diamond-like glass ... that includes a covalent system, and, on a hydrogen-free basis, at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen" and "[f]urthermore, there is no teaching or suggestion of diamond-like glass disposed on a surface of a fluid handling device."

Applicants' Representative respectfully points out that while there is no teaching or suggestion in EP 0856592 of diamond-like glass, it is not necessarily the case that the multilayer coatings of EP 0856592 including diamond-like carbon films and interpenetrating nanocomposite networks do not include a covalent system, and, on a hydrogen-free basis, include

at least about 30 atomic percent carbon, at least about 25 atomic percent, silicon, and less than or equal to about 45 atomic percent oxygen.

Furthermore, while there is no teaching or suggestion in EP 0856592 of diamond-like glass disposed on a surface of a fluid handling device, it is not necessarily the case that EP 0856592 does not disclose a fluid handling device.

**The 35 U.S.C. §112, Second Paragraph, Rejection**

The Examiner rejected claim 19 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. Specifically, the Examiner indicates that the claim is vague and indefinite as to what element/characteristic is imparted to the device to achieve the claimed extinction coefficient. Applicants respectfully traverse this rejection.

Herein, the characteristic of a film described as "optically transmissive" may be defined by the extinction coefficient of the film (specification, page 5, lines 12-14). For example, an optically transmissive film has an extinction coefficient of no greater than 0.3 at 500 nanometers (nm), and preferably no greater than 0.010 at 250 nm (specification, page 5, lines 12-14). Applicants respectfully submit that one of ordinary skill in the art would understand, in view of the disclosed definition, that a fluid handling device including a preferred film of the present invention that includes diamond-like glass can be optically transmissive with an extinction coefficient of no greater that 0.010 at 250 nm.

Reconsideration and withdrawal of the rejection is respectfully requested.

**The 35 U.S.C. §102 Rejection**

The Examiner rejected claims 1, 19-22, and 25 under 35 U.S.C. §102(b) as being anticipated by EP 0 885 983. Applicants respectfully traverse this rejection.

Claims 1, 19, and 25 recite fluid handling devices including films that include diamond-like glass. Claims 20-22 recite fluid handling devices that include a diamond-like glass

(DLG) film. The diamond-like glass includes a dense random covalent system including on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen (claims 1, 19, and 25). The diamond-like glass film includes a dense random covalent system including at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than about 45 atomic percent oxygen, on a hydrogen-free basis (claim 20 and claims 21-22 dependent therefrom).

EP 0 885 983, on the other hand, discloses "Diamond Like Nanocomposite (DLN) compositions consist[ing] of an amorphous random carbon network which is chemically stabilized by hydrogen atoms, interpenetrating with an amorphous glass-like silicon network which is stabilized by oxygen atoms" to provide "a nonsticking homogeneous DLN composition" (EP 0 885 983, column 1, lines 12-16 and 45-46). This composition is not the diamond-like glass including a dense random covalent system as recited in Applicants' claims. Interpenetrating diamond-like films, referred to as DYLYN in the present specification, may have significantly different properties from the diamond-like glass films of the present invention due to the arrangement and intermolecular bonds of carbon atoms (specification, page 14, lines 12-18).

Furthermore, Applicants respectfully draw the Examiner's attention to the fact that EP 0 856 592, cited by the Examiner in the previous Office Action mailed January 14, 2002 and overcome by Applicants' Amendment and Response thereto, is, like EP 0 885 983, drawn to coatings including diamond-like nanocomposite compositions including interpenetrating networks of C:H and Si:O (EP 0 885 983, column lines 12-17 and EP 0 856 592, column 2, lines 32-35).

Applicants have specifically selected diamond-like glass for use in the method and fluid handling devices of the present invention. Diamond-like glass includes "a substantial quantity of silicon and oxygen, as in glass" yet retains diamond-like properties and is "highly transparent and flexible (unlike glass)" (specification, page 13, lines 27-30 and 32-34). Certain

preferred embodiments of the invention include optically transmissive films including diamond-like glass (claims 1, 19, and 25).

Typically, diamond-like glass shows negligible optical absorption in the visible and ultraviolet regions (250 to 800 nm), as indicated at page 2, lines 30-32 of Applicants' Assignees' copending U.S. Patent Application Serial No. 09/519,449, entitled "Diamond-Like Glass Thin Films" incorporated by reference into the present specification at, for example, page 12, lines 30-32. Furthermore, in preferred embodiments, diamond-like glass films of the present invention are at least 50 percent transmissive to radiation at one or more wavelengths from about 180 nm to about 800 nm (claims 29, 30 and 32).

Interpenetrating (DYLYN) films such as those disclosed in EP 0 885 983, on the other hand, do not necessarily provide good uv transparency. For instance, U.S. Pat. No. 5,466,431, cited in an Information Disclosure Statement filed in connection with the present application and considered by the Examiner on January 10, 2002, discloses an interpenetrating glass-like silicon network and diamond-like carbon matrix material (U.S. Pat. No. 5,466,431, column 2, lines 30-34). This material was useful in blocking transmission of ultraviolet through sunglasses and through protective glasses for arc welding (U.S. Pat. No. 5,466,431, column 8, lines 43-48).

Additionally, in preferred embodiments, the diamond-like films of the present invention have substantially no fluorescence (specification, page 9, lines 7-8, claims 27, 28, and 31). Diamond-like glass is a preferred diamond-like film as it displays little if any fluorescence when imaged in a fluorescence microscope (specification, page 25, lines 9-15). It is particularly advantageous, for example, to provide a capillary that exhibits substantially no fluorescence when exposed to the light used to irradiate a target species in the instance where excitation is effected through the capillary wall. Such a capillary, for instance, does not require the film to be removed for optical detection of the samples (specification, page 9, lines 8-9).

There is no teaching or suggestion in EP 0 885 983 of a diamond-like glass coating that exhibits substantially no fluorescence. The DYLYN compositions of EP 0 885 983

are drawn to a non-stick coating having good adherence to a substrate, and a process for providing the coating that facilitates the upscaling to industrial conditions (EP 0 885 983, column 1, lines 44-50). In addition, the examples are drawn a release coating for moulds in an injection moulding process, a release coating for a nylon welding electrode, and a non-stick coating on electro-surgical blades (EP 0 885 983, column 3, line 49 to column 5, line 5). There is no teaching or suggestion in EP 0 885 983 that films including "substantially no fluorescence" such as are provided by certain of the preferred embodiments of Applicants' methods and fluid handling devices including diamond-like glass (claims 27, 28, and 31) are desirable or even recognized.

Furthermore, there is no teaching or suggestion that the EP 0 885 983 non-stick coating compositions provide optical transmissiveness (as in Applicants' claims 1, 19, and 25), or the good uv transparency (as in Applicants' claims 29, 30 and 32) of certain of the preferred embodiments of Applicants' methods and fluid handling devices including diamond-like glass. Additionally, there is no teaching or suggestion that either optical transmissiveness and/or good uv transparency are desirable in the EP 0 885 983 non-stick coatings, or that such characteristics are recognized and selected for in providing the EP 0 885 983 non-stick coatings.

As Applicants submit that EP 0 885 983 neither teaches nor suggests Applicants' invention including diamond-like glass, reconsideration and withdrawal of the rejection is respectfully requested.

**The 35 U.S.C. §103 Rejection**

The Examiner rejected claims 2-18 and 23-24 under 35 U.S.C. §103(a) as being unpatentable over Wilding et al. (U.S. Pat. No. 5,637,469), "Sun International Division, Comar, Inc." or Kopf-Sill et al. (U.S. Patent No. 5,842,787) in view of EP 0 885 983. Applicants respectfully traverse this rejection.

Neither Wilding et al., Sun International Division, Comar, Inc., nor Kopf-Sill teach or suggest the use of diamond-like films, much less the diamond-like glass of Applicants'

invention. Furthermore, EP 0 885 983, as discussed above, also does not teach or suggest diamond-like glass. Therefore, as none of the cited documents teach or suggest the use of diamond-like glass, Applicants submit that the present claims are nonobvious over the cited art.

Reconsideration and withdrawal of the rejection is respectfully requested.

## Summary

It is respectfully submitted that the pending claims 1-11, 13-15, and 17-32 are in condition for allowance and notification to that effect is respectfully requested.

The Examiner is invited to contact Applicants' Representatives, at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

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CERTIFICATE UNDER 37 CFR §1.10:
"Express Mail" mailing label number: EV 152753278 US Date of Deposit: September 18, 2002
The undersigned hereby certifies that this paper is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR §1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Box RCE, Washington, D.C. 20231.

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**APPENDIX A - SPECIFICATION/CLAIM AMENDMENTS INCLUDING NOTATIONS TO INDICATE CHANGES MADE**
**Serial No.: 09/519,448**
**Docket No.: 55436US002**

Amendments to the following are indicated by underlining what has been added and bracketing what has been deleted. Additionally, all amendments have been marked in bold typeface.

## In the Specification

The following new paragraph has been requested to be inserted in the specification at page 14, line 4:

**Thin films made in accordance with the invention may have a variety of light transmissive properties. Thus, depending upon the composition, the thin films may have increased transmissive properties at various frequencies. In specific implementations the thin film is at least 50 percent transmissive to radiation at one or more wavelengths from about 180 to about 800 nanometers. In other advantageous implementations the DLG film is transmissive to greater than 70 percent (and more advantageously greater than 90 percent) of radiation at one or more wavelengths from about 180 to about 800 nanometers. High transmissivity is typically preferred because it allows thicker films to be produced without significant reduction in radiation intensity passing through the film.**

## In the Claims

For convenience, all pending claims are shown below.

1. A fluid handling device comprising a substrate and an optically transmissive diamond-like film disposed on at least a portion of the substrate, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen.

2. The fluid handling device of claim 1 comprising a capillary having an internal surface and an external surface, wherein at least a portion of at least one of the internal or external surfaces includes an optically transmissive diamond-like film disposed thereon.

3. The fluid handling device of claim 2 wherein the external surface of the capillary includes an optically transmissive diamond-like film disposed on at least a portion thereof.

4. The fluid handling device of claim 1 comprising a microfluidic article comprising a microfluidic handling architecture comprising a fluid handling surface, wherein at least a portion of the fluid handling surface includes an optically transmissive diamond-like film disposed thereon.

5. The fluid handling device of claim 4 wherein the optically transmissive diamond-like film is also hydrophilic.

6. The fluid handling device of claim 4 comprising:

a first non-elastic, polymeric substrate comprising a first major surface that includes the microfluidic handling architecture and a second major surface; and

a second polymeric substrate that is integrally bonded to said second major surface of said first substrate, wherein the second substrate is capable of forming a free-standing substrate in the absence of said first substrate.

7. The fluid handling device of claim 4 comprising a cover layer on the microfluidic handling architecture.

8. The fluid handling device of claim 7 wherein the cover layer is bonded to the first major

surface of the first substrate.

9. The fluid handling device of claim 4 wherein the microfluidic handling architecture comprises structures selected from the group consisting of microchannels, fluid reservoirs, sample handling regions, and combinations thereof.

10. The fluid handling device of claim 9 wherein at least one of the structures comprises a fluid handling surface, at least a portion of which has the optically transmissive diamond-like film disposed thereon.

11. The fluid handling device of claim 4 comprising a first polymeric substrate comprising a first major surface that includes a plurality of microfluidic handling architectures and a second major surface, wherein the article is in the form of a roll.

12. CANCELLED

13. The fluid handling device of claim 1 wherein the optically transmissive diamond-like film has disposed thereon linking agents and a reactant affixed to the linking agents to form a binding site.

14. The fluid handling device of claim 13 wherein the linking agents are covalently attached to the diamond-like film.

15. The fluid handling device of claim 13 wherein the reactant is selected from the group consisting of nucleic acids, proteins, and carbohydrates.

16. CANCELLED

17. The fluid handling device of claim 1 wherein the diamond-like film is also hydrophilic.

18. A fluid handling device comprising a microfluidic article comprising a microfluidic handling architecture comprising a fluid handling surface wherein at least a portion of the fluid handling surface includes a hydrophilic diamond-like film disposed thereon, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen.

19. A fluid handling device comprising a substrate and an optically transmissive and hydrophilic film disposed on at least a portion of the substrate, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen, and further wherein the film has an extinction coefficient of no greater than 0.010 at 250 nm.

20. A fluid handling device comprising a substrate and a diamond-like glass film comprising a dense random covalent system comprising at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than about 45 atomic percent oxygen, on a hydrogen-free basis, disposed on at least a portion of the substrate.

21. The fluid handling device of claim 20 comprising a capillary having an internal surface and an external surface, wherein at least a portion of at least one of the internal or external surfaces has the film disposed thereon.

22. The fluid handling device of claim 21 wherein at least a portion of the external surface of the capillary has the film disposed thereon.

23. The fluid handling device of claim 20 comprising a microfluidic article comprising a microfluidic handling architecture including a fluid handling surface wherein at least a portion of the fluid handling surface has the film disposed thereon.

24. A fluid handling device comprising a microfluidic article comprising a microfluidic handling architecture including a fluid handling surface wherein at least a portion thereof has disposed thereon a film comprising diamond-like glass which comprises a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen.

25. A fluid handling device comprising a microfluidic article comprising a microfluidic handling architecture including a non-fluid handling surface wherein at least a portion thereof has disposed thereon a diamond-like film that is optically transmissive, hydrophilic, or both, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen.

26. A method of manufacturing a hydrophilic diamond-like film, the method comprising treating a diamond-like film in an oxygen-containing plasma, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen.

27. (NEW) A fluid handling device comprising a substrate and an optically transmissive diamond-like film disposed on at least a portion of the substrate, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen, and further wherein the film exhibits substantially no fluorescence.

28. (NEW) A fluid handling device comprising a microfluidic article comprising a microfluidic handling architecture comprising a fluid handling surface wherein at least a portion of the fluid handling surface includes a hydrophilic diamond-like film disposed thereon, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen, and further wherein the film exhibits substantially no fluorescence.

29. (NEW) A fluid handling device comprising a substrate and an optically transmissive diamond-like film disposed on at least a portion of the substrate, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen, and further wherein the film is at least 50 percent transmissive to radiation at one or more wavelengths from about 180 to about 800 nanometers.

30. (NEW) A fluid handling device comprising a microfluidic article comprising a microfluidic handling architecture comprising a fluid handling surface wherein at

**least a portion of the fluid handling surface includes a hydrophilic diamond-like film disposed thereon, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen, and further wherein the film is at least 50 percent transmissive to radiation at one or more wavelengths from about 180 to about 800 nanometers.**

**31 (NEW) A method of manufacturing a hydrophilic diamond-like film, the method comprising treating a diamond-like film in an oxygen-containing plasma, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen, and further wherein the film exhibits substantially no fluorescence.**

**32. (NEW) A method of manufacturing a hydrophilic diamond-like film, the method comprising treating a diamond-like film in an oxygen-containing plasma, wherein the film comprises diamond-like glass comprising a dense random covalent system comprising on a hydrogen-free basis at least about 30 atomic percent carbon, at least about 25 atomic percent silicon, and less than or equal to about 45 atomic percent oxygen, and further wherein the film is at least 50 percent transmissive to radiation at one or more wavelengths from about 180 to about 800 nanometers.**